higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

STORED PROGRAM SYSTEMS
NQF LEVEL 3

(10040103)

8 December 2020 (Y-paper)
13:00–16:00

This question paper consists of 6 pages.

459Q1N2008

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TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Label all drawings.
5. Number all terminations.
6. Use IEC symbols all times.
7. Write neatly and legibly.

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QUESTION 1

1.1 List THREE characteristics of a modern, fast-moving, highly competitive industrial company. (3)

1.2 Name TWO disadvantages of factory automation. (2)

1.3 Name ONE user-orientated function carried out by the programmable memory. (1)

1.4 Draw a fully labelled block diagram that shows the FIVE major components of a PLC system. (5)

1.5 An automated processing system makes use of the following:

- 6 sensors
- 1 selector switch
- 2 push buttons
- 2 indication lamps
- 5 motor control relays

Explain what you would consider when choosing a PLC unit. (4)
[15]

QUESTION 2

2.1 Name the THREE technology groups into which sensors are categorised. (3)

2.2 A PLC makes use of different types of input signals that have to be conditioned by the PLC interface.

Name the THREE types of input signal that are produced by sensors. (3)

2.3 Show by means of a fully labelled drawing how the speed of a plastic shaft is measured by using an inductive sensor. (4)

2.4 Show by means of a fully labelled drawing how a 3-wire inductive proximity sensor is wired to a PLC. (6)

2.5 Show by means of a fully labelled drawing how you would use a photoelectric diffuse reflexive sensor to count tins of food on a conveyor belt. (4)
[20]

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QUESTION 3

3.1 Explain the operation of the hardwired (RLL) motor control circuit in FIGURE 1. (4)

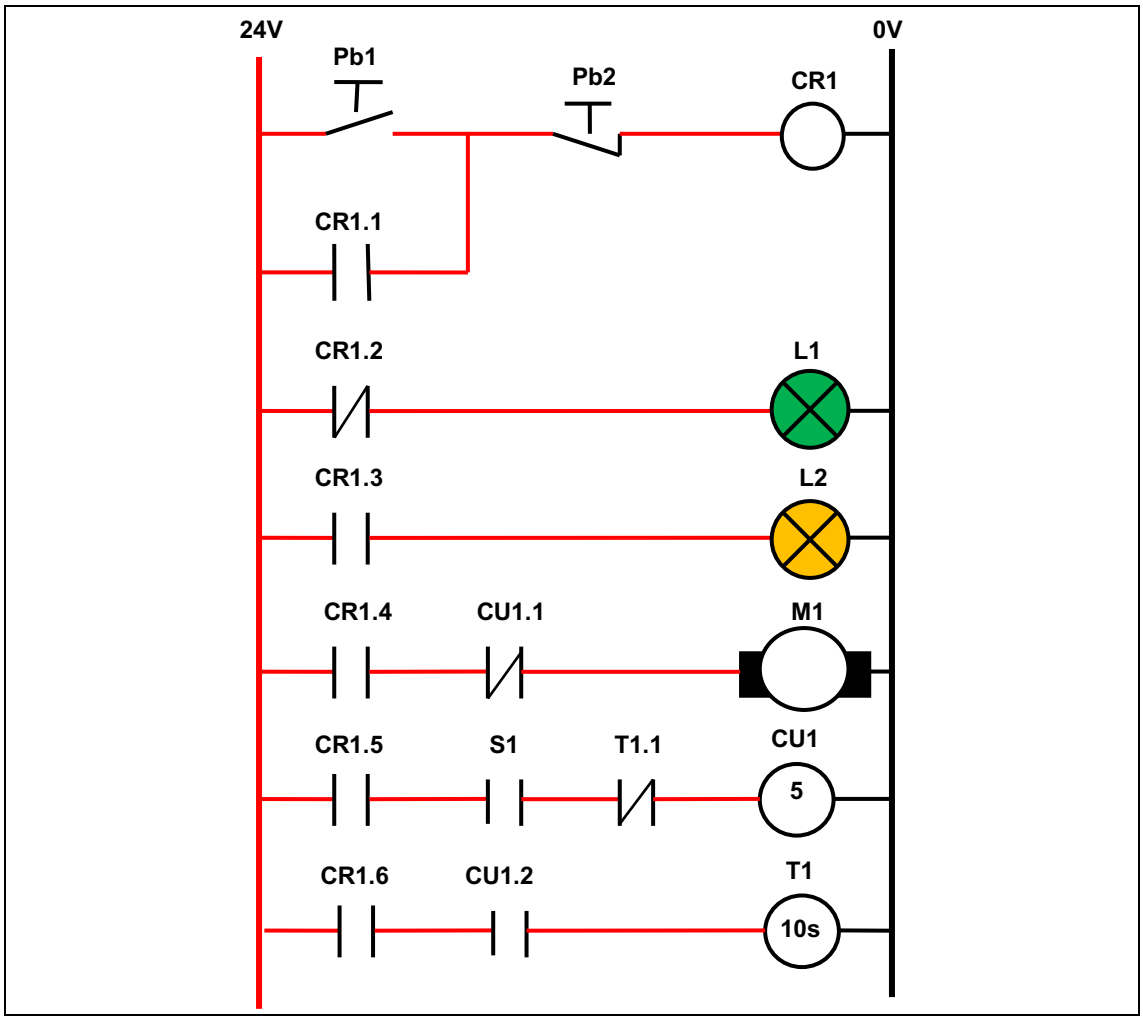


FIGURE 1

3.2 You must modify the hard-wired relay ladder logic motor control circuit in FIGURE 1 so the motor control outcomes can be met using PLC control.

Answer the following related questions.

3.2.1 Draw the following table in your ANSWER BOOK and complete it by filling in the materials required for the modification of the PLC control.

ITEM	DESCRIPTION	MARKING	APPLICATION	ADDRESS

(8)

3.2.2 Draw up the PLC wiring diagram required to meet the needs of the modification. Show all labels a terminal numbers. (8)

[20]

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QUESTION 4

4.1 Write the PLC (LAD) source code to meet the following outcomes:

- The green (STANDBY) lamp will energise at system start-up.
- The amber (RUN) lamp will energise the motor control relay (MCR) when the application is started by pushing the start button.
- The sensor will initiate a count of 5 on the counter and then de-energise the motor control relay.
- A timer will re-energise the motor control relay after 5 seconds have elapsed.
- The application will be turned off and the green standby lamp will energise after the stop button is pushed.

HINT
Ensure that the I/O's match the PLC addresses you allocated in QUESTION 3.2. (15)

4.2 Explain why the hard-wired control was replaced by a PLC control. (4)

4.3 Name TWO programming languages that are considered to be in a written format. (2)

4.4 List the THREE basic logic gates used extensively when programming logic-based source code. (3)

4.5 Differentiate by means of examples between time-based control programming and event-based control programming. (2 × 2) (4)

4.6 Draw the two virtual symbols that would represent the physical components of a push-button (NO) and an indication lamp. (2)
[30]

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QUESTION 5

5.1 Explain what it means if the red LED on the PLC unit flashes during the diagnostic stage of start-up. (2)

5.2 What does a constant green LED during the PLC self-diagnostic stage mean? (2)

5.3 What does a constant amber LED during the PLC self-diagnostic stage at start-up mean? (2)

5.4 What does it mean if the power supply makes a whistling sound or the power LED goes out? (2)

5.5 What does it mean if the input LED on the PLC interface is not illuminated when a push-to-break push-button is wired to the PLC? (2)

5.6 In which circuit could the fault be if the motor control relay is energised but the motor being controlled does not start? (2)

5.7 Name THREE possible faults that could exist in the circuit you identified in QUESTION 5.6. (3)

[15]

TOTAL: 100

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